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Twenty high mental age (MA) subjects and 33 low MA subjects who had been in a free word association test 30 months previously were retested with the Moran 80-Word List. At the time of the previous testing, subjects in the high group had a mean chronological age (CA) of 17.1 and mean MA of 11.5; subjects in the low group had a mean CA of 15.3 and mean MA of 7.6. Associated words were scored for variability of predication, functional relationship, synonym, superordinate, logical coordinate, contrast, faults, and commonality. The low group showed a significant increase in the number of dimension-referent responses (p .01), reduced their reaction time (p .001), and increased their commonality scores (p .01). When all faults were combined, excluding the assonance responses of two subjects, the reduction in faults was significant (p=.001). The results supported the prediction of no significant change in word association structures in the high group and a shift in the direction of the high group by the low group, due to continued maturation during the 30-month interval. (SN)

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Austin, Texas

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The Effects of Maturation on Word Associations of the Mentally Retarded[1]

by

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Abstract

Fifty-three MRs who had been Ss in a free word association test 30 months ago were retested. Data supported the hypothesis predicting stability of word association structures in the older retardates and a shift in the younger Ss' response as a function of maturation.

The Effects of Maturation on Word Associations of the Mentally Retarded

Keilman & Moran (1967) reported that responses given by MRs in a free word association experiment distinguished between High and Low MA Groups. Low MA Ss were lagging in the syntactic-paradigmatic shift with responses dominated by concrete associations and lacking in abstractions. High MA Ss' response structures resembled those of normals.

The authors described the Low MA Group as having the language development of 3 to 3.5-year-old normals. Lenneberg's (1967) work has provided evidence that language development in the normal child is fully established at the end of the fourth year. In their frequently cited study on language development in the mentally retarded, Lenneberg, Nichols, & Rosenberger (1964) report that no change is seen after the 14th year.

At the time the Keilman-Moran data was collected, the Low MA Group had a mean CA of 12.5 years and an MA of 6.8 years. Because Lenneberg's norms indicate a possibility for further language development for the Low MA Group, Keilman & Moran hypothesized that these Ss might represent a group "on the verge of language development."

The present study is a test of that hypothesis. In line with Lenneberg's theory, the High Group's word association structures should remain essentially unchanged. The Low Group, however, in the 30 months intervening between these two studies, should have continued to develop, and should produce responses shifted in the direction of the High Group.

Method

Subjects. Ss from the Keilman and Moran study (1967) remaining in residence at the Austin State School included 20 of the 45 High MA Ss (CA = 17.1; MA = 11.5) and 33 of the 45 Low MA Ss (CA = 15.3; MA = 7.6). Shrinkage of the sample was due to discharge of some Ss from the institution or transfer to some other state institution.

Word Lists and Administration. The Moran (1966) 80-word list was administered to each S. Ss were instructed to say the first word that came to mind when they heard the stimulus word. Reaction time for each response was recorded by stop watch.

Variables. The following variables were scored manually, using a manual consisting of pre-scored responses of 482 University of Texas freshmen (Moran, 1966). Although the manual has been revised

somewhat since the first study, the original manual was again used to facilitate comparison of results.

1. Predication. The stimulus word and response word are adjective-noun or noun-adjective combinations, e.g., red-apple, horse-big.

2. Functional. The stimulus word and the response word each separately denote entities between which there is an explicit functional relationship, e.g., foot-shoe.

3. Synonym. The response word has exactly the same meaning as the stimulus word in one or more ordinary and appropriate contexts, e.g., small-little.

4. Superordinate. The stimulus word denotes an immediate member of the class or category denoted by the response word, e.g., cabbage-vegetable.

5. Logical Coordinate. The stimulus word and response word separately denote immediate members (of equal logical order) of the same class or category, e.g., blue-yellow.

6. Contrast. The response word negates or contrasts with the meaning of the stimulus word in one or more ordinary and appropriate contexts, e.g., dark-light.

7. Faults. Sum of clang associates, blank, distant (unrelated), and multiword associates.

8. Commonality. Each of the Ss' associates was assigned a value corresponding to the number of times that response was given by a total of 482 freshmen. Commonality score was the sum of these values.

Results

The hypothesis was supported with word association structures in the High Group showing no significant changes and with the Low Group shifting significantly in several respects in the direction of the High Group (Table 1).

Insert Table 1 about here

The Low Group showed a significant increase in the number of Dimension-referent responses ($t = 2.99$, $p < .01$); they reduced their reaction time ($t = 6.99$, $p < .001$); and increased their commonality scores ($t = 3.13$, $p < .01$). When all faults were combined, the dif-

ference in the Pre-Post Low Group's scores was not significant. However, two Ss gave only Assonant responses even though they were instructed not to give rhymes. When the Assonance category was not combined with other faults, the reduction in the number of these responses on the Post-test was significant at the .001 level. The Low Group's trend toward more Concept-referent responses ($t = 2.56$, $p < .02$) did not meet the .01 level which was set as criterion for this comparison.

Duncan's New Multiple Range Test (Edwards, 1964) was used to compare response categories for Pre- and Post-tests within each group of Ss. Contrast-Coordinate responses were combined as the Dimension-referent Category; Synonym and Superordinate responses were combined as the Concept-referent category, and Functional (Object-referent) and Predication (Perceptual-referent) responses were analyzed separately (Moran, 1966).

None of the High Group's Post-test responses were significantly different from their Pre-test responses. They continued to give significantly more associations in the Dimension-referent category and fewer Perceptual-referent responses (Table 2).

Insert Table 2 about here

The Low Group significantly increased its Dimension-referent responses over Pre-test (Table 3).

Insert Table 3 about here

Both the High and Low Groups reduced the number of Perceptual responses given, although this reduction was not statistically significant.

Of the Low Group, 18 per cent had sets by Keilman & Moran's criterion of a z-score of .50 for one set and less than .50 for all other sets. Twenty-five per cent of the High Group showed a definite set. In the Low Group there were two Object-referent Ss, the rest had Dimension-referent sets as did all those in the High Group who produced a definite set.

One difference in the scores of those Ss who were still at the Austin State School as compared to those who have been discharged since the original study is a lower score for Commonality. The Low Group Pre-test Commonality scores differed by 312.4 and the High Group Pre-test scores by 183.6. These differences were not significant.

Support for the hypothesis can also be found in the test-retest reliability coefficients shown in Table 4. The trend was towards

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Insert Table 4 about here

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higher reliabilities for the High Group except for Predication and Total Faults. This is understandable as both of these variables are associated with lower levels of verbal development (Moran, 1966).

This trend was also reflected in the stabilities of the factor structures (Tables 5 and 6). The Pre- and Post-test scores for

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Insert Tables 5 and 6 about here

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both groups were intercorrelated, factored by the Principal Components method, and rotated by the normalized Varimax Method. All but one of the analyses yielded three factors with eigenvalues above unity. Factor III from the Post-test of the Low Group had an eigenvalue of .92 but was retained for comparison purposes.

Correlations between the Pre- and Post-test factor scores for the two groups are presented in Table 7. The Low Group showed a

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Insert Table 7 about here

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significant correlation between Factor III of the Pre- and Post-test. This well may be spurious because of the low eigenvalue of the Post-test. The High Group showed two significant correlations. Factor I of the Pre-test correlated .56 with Factor II of the Post-test and Factor III of the Pre-test correlated .65 with Factor II of the Post-test ($p < .05$).

Discussion

Results of this study are congruent with the hypothesis, and with Lenneberg and his colleagues' (1964) research with retarded Ss and with the word association work of Moran and his colleagues (Keilman & Moran, 1967; Moran, 1966; Moran, Mefferd & Kimble, 1964; and Sullivan & Moran, 1967).

Moran (1966) places the associative sets in the developmental sequence: Perceptual-referent, Object-referent, Concept-referent, and Dimension-referent. The ordered relationship of these four modes of response with respect to intelligence (McGaughran and Moran, 1956) and developmental sequence (Bruner and Olver, 1965; Reichard, Schneider and Rapaport, 1944) suggests a hierarchical ranking in terms of linguistic sophistication (Moran, 1966).

The stability of the High Group contrasted with the mobility of the Low Group reflects the importance of maturation as a factor in language development.

The covariance of IQ and verbal ability is seen in both of these groups, with lower IQ associated with the less sophisticated language development of the Low Group Ss.

At the time of the Post-test data collection, the Low Group's MA was 7.6 years, which invites a comparison of these Ss with Sullivan and Moran's (1967) word association structures of "bright" six year olds. Unfortunately the IQ's of the bright Ss are not available. However, of the 101 children in the Sullivan and Moran study, 60.4% had definite sets (z-score $\geq$.50 on one set and no z-score$\geq$.50 on any other set). Distribution of sets in the present study was 18% for the Low Group and 25% for the High Group with all sets being Dimension-referent sets except for two Object-referent sets produced by Low Group Ss.

The level of language development is an important intrapersonal variable which interacts with treatment variables in learning paradigma, a point stressed in detail by Goulet in discussing maturation-experience effects in verbal learning in retardates (Goulet, 1968a; Goulet, 1968b).

Predictions of performance is tasks involving verbal ability and concept formation could profit by being based on a more sensitive measure than the IQ test alone. Word association structures, interpreted for both age and IQ effects, may yield such a tool.

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Footnotes

[1]The authors are indebted to Dr. Louis J. Moran, The University of Texas, for his consultation on this research.

Table 1

Pre- and Post-Test Means and Standard Deviations for Both Groups

High Group

		Pre-Test		Post-Test	
		M	SD	M	SD
1.	Age	175.0	17.54	205.0	17.54
2.	MA	112.4	10.00	138.0	13.62
3.	IQ	67.1	5.66	67.4	5.25
4.	Commonality	5321.9	1286.28	6038.7	1379.37
5.	Coordinate	11.6	4.88	12.3	5.43
6.	Contrast	6.1	2.61	6.65	3.30
7.	Synonym	5.9	2.10	7.8	2.63
8.	Superordinate	4.1	2.61	5.05	2.19
9.	Functional	12.6	4.94	12.95	4.82
10.	Predication	3.8	2.09	3.0	2.73
11.	Assonance	4.2	8.54	3.85	6.67
12.	Distant	2.9	2.95	1.65	1.93
13.	Multi-word	1.5	1.93	1.35	2.91
14.	Blanks	6.7	7.43	3.65	4.34
15.	Reaction Time (Seconds)	4.3	1.38	3.45	1.37

Low Group

		Pre-Test		Post-Test	
		M	SD	M	SD
1.	Age	153.9	27.3	183.9	27.3
2.	MA	71.8	8.6	92.9	17.1
3.	IQ	49.1	9.4	51.3	11.3
4.	Commonality	2884.9	1334.7	3798.9	1682.0
5.	Coordinate	5.9	4.0	8.3	6.38
6.	Contrast	1.5	1.77	3.7	3.26
7.	Synonym	2.6	1.95	4.1	2.7
8.	Superordinate	2.6	1.97	3.1	1.93
9.	Functional	11.6	4.78	14.1	7.32
10.	Predication	6.1	2.9	4.7	3.11
11.	Assonance	2.2	3.03	8.4	17.68
12.	Distant	7.0	6.68	6.3	6.28
13.	Multi-word	8.0	9.2	3.9	6.86
14.	Blanks	12.2	9.81	7.76	9.6
15.	Reaction Time (Seconds)	6.1	2.3	3.8	1.62

Table 2

Duncan's Range Test for Response Distributions of the High Group on Pre and Post Tests

	1	2	3	4	5	6	7	8	
									Shortest Significant Ranges
Means	3.00	3.80	9.95	12.60	12.95	12.95	17.70	18.95	
1. 3.00		0.80	6.95	9.60	9.95	9.95	14.70	15.95	R_2 = 3.78
2. 3.80			6.15	8.80	9.15	9.15	13.90	15.15	R_3 = 3.95
3. 9.95				2.65	3.00	3.00	7.75	9.00	R_4 = 4.05
4. 12.60					0.35	0.35	5.10	6.35	R_5 = 4.13
5. 12.95						0.00	4.75	6.00	R_6 = 4.20
6. 12.95							4.75	6.00	R_7 = 4.25
7. 17.70								1.25	R_8 = 4.30

1 2 3 4 5 6 7 8

Groups are: 1. Post-test Perceptual Referent; 2. Pre-test Perceptual Referent; 3. Pre-test Conceptual Referent; 4. Pre-test Object Referent; 5. Post-test Conceptual Referent; 6. Post-test Object Referent; 7. Pre-test Dimension Referent; 8. Post-test Dimension Referent

Table 3

Duncan's Range Test for Response Distributions of the Low Group on Pre and Post Tests

	1	2	3	4	5	6	7	8	
Means	4.67	5.27	6.06	7.24	7.45	11.61	11.97	14.09	Shortest Significant Ranges
1. 4.67		0.60	1.39	2.57	2.78	6.94	7.30	9.42	R_2 = 3.35
2. 5.27			0.79	1.97	2.18	6.34	6.70	8.82	R_3 = 3.50
3. 6.06				1.18	1.39	5.55	5.91	8.03	R_4 = 3.59
4. 7.24					0.21	4.37	4.73	6.85	R_5 = 3.66
5. 7.45						4.16	4.52	6.64	R_6 = 3.72
6. 11.61							0.36	2.48	R_7 = 3.76
7. 11.97								2.12	R_8 = 3.81
	1 2		3 4		5	6	7	8	

Groups are: 1. Post-test Perceptual Referent; 2. Pre-test Conceptual Referent; 3. Pre-test Perceptual Referent; 4. Post-test Conceptual Referent; 5. Pre-test Dimension Referent; 6. Pre-test Object Referent; 7. Post-test Dimension Referent; 8. Post-test Object Referent

Table 4

Test-retest Reliability Coefficients
for Raw Scores for High and Low Groups

		High	Low
1.	Commonality	.46	.40
2.	Coordinate	.53	.26
3.	Contrast	.46	.20
4.	Synonym	.33	.37
5.	Superordinate	.51	.19
6.	Functional	.51	.24
7.	Predication	.05	.30
8.	Faults	.39	.49

Table 5

Normalized Varimax Rotated Factors for the Low Group, Pre-Test Responses

	Variable	Factors I	II	III	h^2
1.	Commonality	.7046	-.4731	.3171	.82
2.	Coordinate	.1422	-.8280	.1253	.72
3.	Contrast	.5112	-.6937	-.2328	.80
4.	Synonym	.2327	-.5312	.6618	.77
5.	Superordinate	.0414	.1146	-.0019	.88
6.	Functional	.8080	.1536	-.0787	.68
7.	Predication	.4034	.6202	.9305	.55
8.	Faults	-.8493	.2198	-.2657	.84

Normalized Varimax Rotated Factors for the Low Group, Post-Test Responses

	Variable	Factors I	II	III	h^2
1.	Commonality	.7508	-.5757	.0612	.90
2.	Coordinate	-.1584	-.9132	.1044	.87
3.	Contrast	.1262	-.8331	-.2311	.76
4.	Synonym	.4287	-.6000	-.0341	.54
5.	Superordinate	.8515	-.0899	.0085	.73
6.	Functional	.8613	.0610	.2291	.80
7.	Predication	.1750	.0579	.9493	.94
8.	Faults	.5575	.6689	-.3834	.91

Table 6

Normalized Varimax Rotated Factors for the High Group, Pre-Test Responses

	Variable	Factors I	II	III	h^2
1.	Commonality	.8569	.3328	.0144	.85
2.	Coordinate	.1470	.1860	-.8393	.76
3.	Contrast	-.0285	.7767	-.1265	.62
4.	Synonym	.5978	-.1299	-.4647	.59
5.	Superordinate	.6968	-.0447	.1207	.50
6.	Functional	.5427	-.1534	.7402	.87
7.	Predication	.0380	-.8557	.0801	.74
8.	Faults	-.7842	.2640	.0818	.69

Normalized Varimax Rotated Factors for the High Group, Post-Test Responses

	Variable	Factors I	II	III	h^2
1.	Commonality	.5164	.4517	.5368	.76
2.	Coordinate	.7264	-.5878	.0467	.88
3.	Contrast	.8380	.2130	-.1635	.77
4.	Synonym	.2384	-.1465	.8350	.78
5.	Superordinate	-.2630	.0701	.7331	.61
6.	Functional	-.2386	.8930	.0279	.86
7.	Predication	-.8412	.0866	-.1407	.73
8.	Faults	-.2468	-.7198	.0308	.58

Table 7

Intercorrelations Between Pre- and Post-Test Factor Scores for Both Groups

Low Group

		Post-test Factors 1	2	3
Pre-test Factors	1	.2685	-.3044	.1043
	2	.0231	.2819	.0890
	3	.2129	.0844	.4344*

High Group

		Post-test Factors 1	2	3
Pre-test Factors	1	.2320	.1247	-.5572*
	2	.1481	-.0657	-.2043
	3	-.2691	.6482**	.0366

* $p < .05$
** $p < .01$